



Great Lakes Science Center

North American Freshwater Clams



Native Clams Facing Extinction

Freshwater native clams have a number of different common names, including freshwater pearly mussels, native freshwater mussels, naiads, or unionids. These native clams are found on every continent except Antarctica, but the greatest diversity, approximately 270 species belonging to the family Unionidae, occurs in North America. Over the past century, native clam species have suffered severe declines in diversity and abundance due to human impacts on aquatic habitat, commercial harvesting, the introduction of carp, water pollution, and the recent invasion of zebra mussels (*Dreissena polymorpha*). Freshwater native clams are the most endangered animal group in North America. A total of 72% of our 270 native mussel species are listed as recently extinct, endangered, threatened, or of special concern. By comparison, only 33% of all plants and other animals in the United States are considered at-risk according to the Nature Conservancy.

What Are Freshwater Unionids?

Native clams or unionids live in every type of river and lake and are easily recognized by their hinged shell. The shape, size, thickness, and color of the shell varies greatly between species, but in all unionids, the shell forms a protective hinged box, completely covering the soft body of the clam. The shell is composed of three layers: a brownish outer skin, a middle rough calcareous layer, and a smooth inner layer, the nacre. The nacre is often colored deep pink or purple and is called mother-of-pearl. The shell can be large, with records of animals 36 inches in length reported from the Mississippi River in the early 1900s. Typically, most unionids are less than 12 inches in length. Unionids are long-lived animals, reaching ages greater than 100 years, and many species do not even become sexually mature until they are 8-10 years old.

These animals are found with their shell half buried in the mud or gravel. They orient themselves so that their head and foot are in the mud, and their rear end is up in the water column.

Unionids can crawl and change locations, but they are slow, capable of moving less than 10 feet per day. Most remain fairly stationary unless some habitat stress occurs.

Since unionids are not very mobile, finding a member of the opposite sex can be difficult. Sexes are usually separate, but if a clam is isolated from a member of the opposite sex, it can turn into a hermaphrodite, both male and female, and fertilize its own eggs. Otherwise, male mussels release their spermatozoa into the water and the females filter the sperm from the water; fertilization is internal. Female mussels brood their young from the egg to the larval stage in their gills. In the spring or summer, depending on species, they expel the larvae, called glochidia, into the water where they attach to the gills or fins of an appropriate fish host in order to become encysted and complete their metamorphosis to the juvenile stage. Unionid larvae are limited to the type of fish they can use as hosts—only certain species are acceptable.

Some female clams have a unique way of attracting the right type of fish. These females have developed a fake fishing lure that looks like an item the fish would like to eat, and the clam wiggles this lure so that it looks alive. When a fish tries to eat the lure, the female unionid releases glochidia that attach to the fish. After a period of attachment to the fish ranging from 1 to 25 weeks, depending on the type of unionid, the juvenile mussel detaches from its host and falls to the substrate to complete its development into a free-living adult. Some species may successfully use a variety of fishes, but the majority are thought to be host-specific. It is partly because of this dependency on the glochidial host that mussels are so sensitive to environmental



disturbances. Not only are they threatened by disturbances that impact them directly, but also those that affect the host fish populations. In several cases, mussel species have become functionally extinct due to the decline or disappearance of host fish species.

The importance of unionids to the ecosystem relates directly to their feeding habits and their size. Unionids are nature's water filtration plants. They are filter feeders that process up to 10 gallons of water per clam per day. As this water moves through the unionid, finger-like structures called cilia, located on the gills, catch and remove any particles in the water column. The unionid sorts through these particles and eats some materials and spits out others. Unionids feed on many different items, but bacteria such as *E. coli*, and the types of blue-green algae that causes taste-and-odor problems in human water supplies are favored foods. Since unionids are one of our largest freshwater invertebrates and at one time occurred in densities of over 100/sq. yard in many watersheds in North America, their importance in keeping waters clear cannot be underestimated.

The vulnerability of native unionids to human-derived impacts can be attributed to a number of factors. Since they are long-lived filter feeders that are very stationary, they tend to accumulate and concentrate toxins over many years. Many unionid communities have been poisoned due to industrialization of the surrounding landscape that occurred in the 1950s and 1960s. They also suffer from dredging activities, because they cannot move away from the dredge, and they are often killed by the damming of rivers to create lakes. Unionids do not respond well to chlorine residues or the chemicals used to kill aquatic weeds in the lakes or on lawns along the shoreline. Further problems have been caused by the required relationship between unionid larvae and fish.

The "Pearl Rush"

Population declines have also occurred through direct predation and harvesting of unionids by humans. Native clams were frequently used as food items by Native American tribes and early European settlers. The discovery of a large pearl in the 1850s in a clam in Ohio started a massive "Pearl Rush" reminiscent of the California gold rush. Hundreds of thousands of unionids were destroyed in what proved to be a fruitless search for pearls. While all unionids can form pearls in response to some irritating sand grain or parasite that gets trapped inside the shell by the nacre, most such pearls are chalky and soft and of no value. Just as the "Pearl Rush" died down, a commercial button industry formed to make buttons from the nacre of the shell. By 1912, there were 200 button factories in the United



States, harvesting 60 thousand tons of unionid shell per year, representing an estimated 600 million live animals. Shell was so valuable that harvesters were known to use cannons to blow competitors' boats out of the water. This button harvest continued unabated until the 1920s, with fewer and fewer live unionids found each year. The development of plastic buttons halted the harvest of shell for buttons. However, after World War II, a new threat appeared, with the use of unionid shell as part of the cultured pearl industry. The rise in popularity of cultured pearls required the use of some sort of core for the pearl oyster to use as a base for the pearl. Beads cut from the shell of certain unionid species proved most effective for this purpose. At this time, any cultured pearl sold in the world has a piece of North American unionid shell as its core. Further decline in unionid populations has led to widespread poaching of animals from areas not open to harvest. In response to this poaching activity, it is now against the law to possess a live unionid or a unionid shell in the state of Michigan.

What You Can Do To Help.

Conservation efforts to help these animals are not limited to just state and federal agencies. You too can play an important role in ensuring the survival of this declining resource. If you find native clams in your local river or lake, please leave them alone and encourage others to do so too. Unionidae do not live long in aquaria or garden pools. They cannot survive if removed from the water, nor can they crawl back into the water from shore. If you live along a river or lake and use lawn herbicides and pesticides, please do not apply them close to shore. Unionids are not the only aquatic animals harmed by these chemicals. Unionids are no longer safe to eat, unlike the salt-water clams, due to the accumulation of decades of pollutants including PCBs, dioxins, and fecal coliform bacteria in the freshwater animals. As mentioned earlier, it is now against the law to harvest, kill, or possess a live unionid or a unionid shell in the state of Michigan. However, laws do not conserve living animals, people do. The combined efforts of many people will be needed if these animals are to survive in the 21st century.

